

## LA-UR-19-32737

Approved for public release; distribution is unlimited.

Title: Manufacturing Modernization Project, 5-Year Plan

Author(s): Fresquez, Nancy Leigh  
Cordova, Rebecca Deeann

Intended for: Report

Issued: 2019-12-24

---

**Disclaimer:**

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



# Manufacturing Modernization Project

## 5-Year Plan

Updated by Rebecca Cordova and Nancy Fresquez, ORI-3

December 04, 2019



---

# Manufacturing Modernization Project 5-Year Plan



**LA-UR-20-XXXX**

# Approvals

---

*Rebecca Cordova, ORI-3 Project Leader*

*Date*

---

*Michael Stoll, NSPI-DO Program Director*

*Date*

---

*David Costa, ORI Division Leader*

*Date*

## Revision History

Version	Date	Description
0.0	<i>4/30/2019</i>	Initial Draft
0.1	<i>7/31/2019</i>	Final Draft incorporating budget and schedule estimates.
0.2	<i>11/07/2019</i>	Revision to reflect changes in FY20 budget and scope

## **Table of Contents**

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>6</b>
<b>2.0</b>	<b>VISION .....</b>	<b>6</b>
<b>3.0</b>	<b>CURRENT STATUS .....</b>	<b>7</b>
<b>4.0</b>	<b>FY20 – FY24 PLAN .....</b>	<b>7</b>
4.1	Chronological Overview .....	8
4.2	Deliverables, Schedule, and Budget Estimate by Product Line.....	11
4.3	Approach.....	18
	<b>APPENDIX A: DIGITAL MANUFACTURING VISION .....</b>	<b>19</b>
	<b>APPENDIX B: SYSTEM AND BUSINESS PROCESS REQUIREMENTS .....</b>	<b>19</b>
	<b>APPENDIX C: PROJECTS LIST .....</b>	<b>24</b>

## 1.0 INTRODUCTION

The Los Alamos National Laboratory (LANL) Associate Laboratory Director for Weapons Production (ALDWP) has developed a vision for the use of digital manufacturing technologies to provide improved program performance for plutonium operations. Collectively, these technologies include both new hardware and new software, as well as significant implementation of improved processes across multiple mission areas and their associated product lines. The overarching vision encompasses four major functional areas of productive manufacturing output:

- Production data collection and product sale
- Production planning and scheduling
- Production inventory management
- Production operations

This five-year plan focuses on the first functional area, product data collection and product sale, and lays out a path for effective implementation of this capability to realize program performance improvements that are needed to execute the Laboratory's missions. The other functional areas are an integral part of the overall vision for digital manufacturing; however, their implementation is funded independently of the first functional area's implementation. Some information related to these other areas is included to allow the reader to understand the overall ALDWP vision and how these activities are to be integrated to support that vision.

## 2.0 VISION

This vision recognizes the rather unique requirements derived from manufacturing operations involving special nuclear materials and the quality requirements associated with nuclear weapons and other high-visibility missions. A detailed set of statements that describe the overall vision for digital manufacturing at LANL are included in Appendix A. This plan is focused on those components of the vision that are necessary to execute the collection of production data and use this data in the electronic sale of product. The statements specific to this functional area are:

- A single system used to accomplish real-time tracking of task-level work completion in the plant;
- A single process used to define data requirements for all production activities including fabrication of products for sale;
- A single system used to collect real-time production data whether for product sale, production process improvements, or general research;
- A single electronic system used to demonstrate products meet requirements and facilitate product sales;
- All production operational data available in an authoritative system for engineering analysis.



### 3.0 CURRENT STATUS

The first phase of the Manufacturing Modernization Project (MMP) established a base level of digital manufacturing capability at the Lab's plutonium facility. MMP implemented the following combination of software tools, collectively known as the Manufacturing Management System (MMS):

- Solumina Manufacturing Execution System (MES), a software system integrated with the existing Oracle Manufacturing Resource Planning (MRP) system that connects, monitors, and controls complex manufacturing systems and data flows;
- Digital Data Acquisition (DDA), a custom module to collect quality evidence from certain instruments electronically;
- Electronic Sales Package (ESP), a custom module that displays as-built quality evidence to meet the requirements of Weapon Quality Policy (NAP-24A) and walks the user through a submittal and approval of this evidence;
- Digital Build Book, a custom module that automatically generates the actual digital compilation of the data viewed in ESP, as well as any attachments and original design documents, into a pdf that can be archived as a digital record.

These software tools were deployed in LANL's Power Supply Assembly (PSA) operations beginning in 2017. MMP components were used in the spring of 2018 to build and electronically sell "trainers." Product Engineers working with implementation team members created detailed work plans and followed them through the system to capture production and quality evidence. ESP functionality and DDA implementation were limited, and the Build Book was not available in the production environment at the time of these early product sales.

As a continuation of that effort, MMP was focused in FY19 on a limited number of tasks to improve the capability in PSA operations and sales. These tasks were completed in FY19 with the exception of Build Book, which was completed October FY20.

- The project has now demonstrated full DDA functionality for all instruments in the PSA work plan. There is ongoing support to assist Product Engineers in tuning the algorithms that perform calculations on the instrument data.
- A second effort was recently completed to reduce the risk associated with loss of a data stream due to network disruptions. PSA data is collected on the unclassified network and must be pushed to the MES that resides on the classified network. A disruption in this data push may result in a loss of data necessary to sell product under the original DDA design. A redundant data system was implemented in FY19 to eliminate this risk.
- Finally, network security compliance issues were resolved to fully enable generation of the Build Book in FY19. The full Build Book capability will not be available until the first quarter of FY20.

## 4.0 FY20 – FY24 Plan

Building on the work already accomplished by MMP, the effort defined in this 5-year plan will deliver the production data collection and product sale vision across all Weapons Production Directorate product lines. Appendix B includes a description of how system requirements and business processes will be implemented by the project to achieve the five vision statements in section 2.0 of this plan.

It should be noted that as the project completes each phase of implementation, the software tools will transition from this project to the Operations and Maintenance (O&M) budget for production support systems. This will require a corresponding increase in scope and budget for the O&M activities.

### 4.1 Chronological Overview

#### *Fiscal Year 2020*

As a result of a \$3M shortfall in anticipated funding in FY20, the scope and deliverables for FY20 and the out years will be adjusted to reflect the shortfall. The project will focus on the implementation of existing tools for pit production operations in PF-4 and the planning required for implementation for operations with Pu-238 in PF-4. Tools are already developed for serialized product lines, so the focus of the project in FY20 is the implementation of the tools, including working with Process and Quality Engineers from the Actinide Materials Processing and Power (AMPP), Production Agency Quality (PAQ), and Pit Technologies (PT) divisions. This work, which begins in FY20 and continues through the out years, can be organized around the following focus areas:

1. Initial work will begin in FY20 for the implementation of electronic sales for Pits. The work consists of the following:
  - a. Perform a Gap Analysis
  - b. Requirements Gathering for ESP and Build Book
  - c. Design of ESP and Build Book
  - d. Migration and testing of ESP and Build Book
  - e. Configuration of MRP and MES through Red Beta Instance
  - f. Creation of a select number of process (Work Plan) based on Gap Analysis through Red Beta.

**Notional Functionality Schedule for FY20 Projects**

	FY20 Project(s)	Project Activity	Duration	Cost	Notional “Functionality”
1.	Power Supplies		1 Year (Q1-Q4)	\$1.6M	
2		PSA (Q1)	1 Month	\$350K	Complete remaining MMP related Digital Build Book Scope. This activity was completed at end of October 2019.
3		PF-4 Planning & Design for Electronic Sales (Q3-Q4)	6 Month	\$1.3M	Prepare and deliver an interim analysis report detailing the status of Q3 and Q4 efforts for PF4 Power Supply Scope.

	FY20 Project(s)	Project Activity	Duration	Cost	Notional "Functionality"
4	Pits		1 Year (Q1-Q4)	\$2M	
5		Planning and Design for Electronic Sales (Q1-Q2)	6 Month	\$1.080M	Prepare and deliver and interim analysis report detailing the status of Q1 and Q2 scope for Pits, to include design for ESP requirements, design for Build Book requirements, and progress of unclassified and classified system development testing.
6		Planning and Design for Electronic Sales/Development for Electronic Sales (Q3-Q4)	6 Month	\$0.920M	Prepare and deliver a FY20 end of year report detailing overall status for Pit Scope in relation to activities outlined in baseline schedule; completion of Production Quality Requirement Matrix (PQRM) build.

### *Fiscal Year 2021*

In FY21, the project will continue with the implementation of electronic sales for Pits. The project will also begin evaluating if it is feasible to implement digital data acquisition for pit production. It is expected that not all data collection can be done digitally due to limitations of the hardware used in the production line. It is recognized that DDA typically requires significant customization by software developers.

In FY21, there may be an opportunity to begin the development phase of the software lifecycle to implement lot-based product sales. The development activities should continue in FY21 and allow us to complete the implementation of digital manufacturing for Pu-238 in PF-4 by the end of the FY22. The development of lot-based capabilities for MES will also be work that can be applied to later phases for the PF-4 balance of plant and detonator production operations.

### *Fiscal Year 2022*

In FY22, the project will continue working on deliverables for Pits electronic sales, including digital data collection. In early FY23, formal acceptance will be completed for Pu-238 programs. The project will continue to move into the planning, design and development phases for the balance of operations that are in PF-4. This will include at a minimum ARIES and Americium production. Since both serialized and lot-based tools have been developed by this time, it is expected that there will be very little software development activity for the PF-4 balance of plant application of ESP, MES, or Build Book.

### *Fiscal Years 2023 and 2024*

In Q1FY23 final testing and implementation activities will continue, resulting in formal acceptance in Q2FY23. The last two years of this plan will see the completion of digital data collection requirements for the balance of the plant in PF-4. The gap analysis, previously performed by the project for detonator production, will be updated and replacement of the Secure Operation Management System (SOMS) will be evaluated in FY24. The previous gap analysis determined a significant software development effort would be involved in replacing SOMS as more than 30 technology gaps that would take ~ 3 years of effort to close were identified.

## MRP/MES and MMP Schedule and Resources

Product Line	Scheduled Project Phases															
	FY20				FY21				FY22				FY23			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pits	Planning and Design for Electronic Sales				Development for Electronic Sales (MES, ESP, Build Book)				DDA Planning and Design				DDA Testing & Implementation			
Pu-238	Planning and Design for Electronic Sales				Development for Electronic Sales (MES, ESP, Build Book)				DDA Planning and Design				DDA Testing & Implementation			
Balance of Plant	Planning and Design for Electronic Sales				Development for Electronic Sales (MES, ESP, Build Book)				DDA Planning and Design				DDA Testing & Implementation			
Detonator Production	Planning and Design for Electronic Sales				Development for Electronic Sales (MES, ESP, Build Book)				DDA Planning and Design				DDA Testing & Implementation			
Key	Product Line Analysis Complete				Design and Development Complete				Testing and Debugging Complete				Implementation Activity Complete			
Line	FY20 Budget				FY21 Budget				FY22 Budget				FY23 Budget			
	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project	O&M	MMP Project
Pits		\$2,000,000		\$4,664,000				\$2,645,000				\$2,000,000				
Pu-238		\$1,300,000		\$2,776,000				\$3,768,000				\$521,000				
BOP								\$715,000				\$6,088,000				\$1,176,000
Dets																\$480,725
Total <sup>(1)</sup>	\$5.7 M	\$3.3 M	\$6.2 M	\$7.44 M			\$6.8 M	\$7.128 M			\$7.5 M	\$8.609 M		\$8.1 M		\$1,656,725 M

Notes: (1) DET's resources for O&M are reflected in budget  
(2) FY24 DET's budget assumes decision is made to replace SOMS

Figure 1 – Schedule and Budget of Major Project Phases and Deliverables

## 4.2 Deliverables, Schedule, and Budget Estimate by Product Line

### *Pit Production*

The schedule with associated deliverables and milestones is presented for FY20 through FY23, at which point Pit Production will have all necessary capability in place to support that mission.

The goal of FY20-22 is to implement a functional electronic sales capability for Pits using:

- Solumina Manufacturing Execution System (MES) and the Oracle Manufacturing Resource Planning (MRP) System
- Electronic Sales Package (ESP), and
- Build Book.

These tools have already been developed and implemented for PSA electronic sales by the project. Some customization for this product line will be required and is included in this plan as are efforts to work with the Process and Quality Engineers to implement the system on the floor. Customization is expected to be minimal since this is a serialized product line that from a production control perspective is very similar to the PSA product line already implemented.

In FY21 we will initiate an evaluation for Digital Data Acquisition use for Pits. This evaluation will drive specific development tasks in FY22 to customize and implement DDA to the extent required by the Pu Sustainment Program Manager to meet future mission deliverables. This evaluation could significantly impact the schedule in Table 1 for FY21-23. The Pu Sustainment Program Manager could identify a very limited set of DDA requirements that would allow early completion. The schedule in Table 1 assumes that the program manager accepted requirements for DDA will be a moderate work load.

**Table 1 – Pit Product Line Tasks, Deliverables, Milestones, and Budget**

FY20			
Q1	<ul style="list-style-type: none"> <li>Planning and Design for Electronic Product Sales</li> </ul>	<ul style="list-style-type: none"> <li>Initiate product line analysis, including process analysis, requirements, gap analysis, and production plan.</li> </ul>	Pits FY20 Total Cost Estimate: \$2,000,000
Q2	<ul style="list-style-type: none"> <li>Planning and Design for Electronic Product Sales</li> <li>Development and Implementation of Electronic Product Sales (MES, ESP, Digital Build Book)</li> </ul>	<ul style="list-style-type: none"> <li>Continue product line analysis, including process analysis, requirements, gap analysis, and production plan.</li> <li>Initiate development of training plans, procedures and MES work plans.</li> </ul>	
Q3	<ul style="list-style-type: none"> <li>Planning and Design for Electronic Product Sales</li> <li>Development and Implementation of Electronic Product Sales</li> </ul>	<ul style="list-style-type: none"> <li>Continue product line analysis, including process analysis, requirements, and production plan.</li> <li>Continue development of training plans, procedures and MES work plans.</li> </ul>	

Q4	<ul style="list-style-type: none"><li>Development and Implementation of Electronic Product Sales</li><li>Begin Development of ESP and Build book for Pit Product Line</li></ul>	<ul style="list-style-type: none"><li>Continue development of training plans, procedures and MES work plans.</li><li>Based on Gap Analysis begin development activities for ESP and Build book unique to Pit Product Line</li></ul>	
FY21			
Q1	<ul style="list-style-type: none"><li>Development and Implementation of Electronic Product Sales</li><li>Development and Testing for Electronic Product Sales</li><li>DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>Continue development of MES work plans.</li><li>Complete the testing and debugging of the electronic sales capability.</li><li>Initiate implementation activities for electronic sales capability.</li><li>Initiate user training.</li><li>DDA analysis, including requirements and gap analysis.</li></ul>	Pits FY21 Total Cost Estimate: \$4,664,000
Q2	<ul style="list-style-type: none"><li>Development and Implementation and Acceptance of Electronic Product Sales Capability</li><li>DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>Complete user training.</li><li>Complete acceptance for electronic sales.</li><li>Complete analysis for DDA.</li><li><b>Proposed Milestone:</b> Capability for Electronic Sales of Pits is implemented and accepted for production at the end of 2QFY21.</li></ul>	
Q3	<ul style="list-style-type: none"><li>DDA Development</li><li>Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>Initiate DDA development</li><li>Initiate updates to the MMP tools (MES, ESP, and Digital Build Book), if required to implement the DDA changes.</li></ul>	
Q4	<ul style="list-style-type: none"><li>DDA Development</li><li>Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>Continue DDA Development</li><li>Continue updates to the MMP tools (MES, ESP, and Digital Build Book), if required to implement the DDA changes.</li></ul>	
FY22			
Q1	<ul style="list-style-type: none"><li>DDA Testing and Implementation</li><li>Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>Initiate implementation to include the testing and debugging of DDA and continue updates, if needed.</li><li>Continue updates to the MMP tools (MES, ESP, and Digital Build Book), if required to implement the DDA changes.</li></ul>	Pits FY22 Total Cost Estimate: \$2,645,000
Q2	<ul style="list-style-type: none"><li>DDA Testing and Implementation</li><li>Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>Continue implementation to include the testing and debugging of DDA and continue updates, if needed.</li><li>Continue updates to the MMP tools (MES, ESP, and Digital Build Book), if required to implement the DDA changes.</li></ul>	
Q3	<ul style="list-style-type: none"><li>DDA Testing and Implementation</li><li>Updates to Electronic Sales Capability, if needed.</li><li>Develop lessons learned from Pits product line</li></ul>	<ul style="list-style-type: none"><li>Complete DDA testing and implementation.</li><li>Complete the updates to the MMP tools (MES, ESP, and Digital Build Book).</li><li>Initiate project lessons learned documentation for Pits product line.</li></ul>	
Q4	<ul style="list-style-type: none"><li>DDA Acceptance</li><li>Develop lessons learned from Pits product line</li></ul>	<ul style="list-style-type: none"><li>Complete acceptance for DDA.</li><li>Complete project lessons learned documentation for Pits product line.</li><li><b>Proposed Milestone:</b> Capability for digital data collection in support of Pit manufacturing is implemented and accepted for production at the end of 4QFY22.</li></ul>	

FY23			
Q1	<ul style="list-style-type: none"> <li>• DDA Testing and Implementation</li> <li>• Begin Updates to ESP due to DDA implementation, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue testing and implementation activities for DDA for Pits.</li> <li>• Begin updates to ESP and Build book due to DDA Implementation.</li> </ul>	Pits FY23 Total Cost Estimate: \$2,000,000
Q2	<ul style="list-style-type: none"> <li>• Acceptance of DDA</li> <li>• Continue Updates to ESP due to DDA implementation, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Perform Acceptance Process.</li> <li>• Continue updates to ESP and Build book due to DDA implementation.</li> </ul>	
Q3	<ul style="list-style-type: none"> <li>• Continue Updated to ESP due to DDA implementation, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Proposed Milestone:</b> Pits DDA in Production.</li> <li>• Continue updates to ESP and Build book due to DDA implementation.</li> </ul>	
Q4	<ul style="list-style-type: none"> <li>• Finish Updated to ESP due to DDA implementation.</li> </ul>	<ul style="list-style-type: none"> <li>• All updated to ESP and Build book complete.</li> </ul>	

### *Pu-238 Operations in PF-4*

The Pu-238 product line is fundamentally different from previous implementations of the MMS set of tools. Pu-238 uses lot-based production, which will necessitate some customization of the tools to implement the electronic sales capability. The schedule presented in Table 2 reflects the greater complexity of these tasks.

As done for the Pits product line, we will complete an evaluation for Digital Data Acquisition use for Pu-238 operations in PF-4. The evaluation will drive specific tasks to customize and implement DDA to the extent required by the Pu-238 Program Manager to meet future mission deliverables. This evaluation could significantly impact the schedule in Table 2. Alternatively, the Pu-238 Program Manager could identify a very limited set of DDA requirements that would allow early completion. The schedule in Table 2 assumes that the program manager accepted requirements for DDA will be a moderate work load, as it was assumed for the Pits product line. This product line will already be in full production for WR product when the MMP tools are implemented. This may require modifications to the scheduling of specific tasks so that they do not interfere with the production schedule.

**Table 2 – Pu-238 Product Line Tasks, Deliverables, Milestones, and Budget**

	Scope	Tasks / Deliverables / Milestones	Budget Estimate
FY20			
Q3	<ul style="list-style-type: none"><li>Planning and design for lot-based Electronic Product Sales</li></ul>	<ul style="list-style-type: none"><li>Initiate the product line analysis, including process analysis, requirements, gap analysis, and production plan.</li></ul>	Pu-238 FY20 Total Cost Estimate: \$1,300,000
Q4	<ul style="list-style-type: none"><li>Planning and design for lot-based Electronic Product Sales</li></ul>	<ul style="list-style-type: none"><li>Complete the product line analysis, including process analysis, requirements, gap analysis, and production plan.</li></ul>	
FY21			
Q1	<ul style="list-style-type: none"><li>Development for Electronic Product Sales</li><li>DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>Initiate the development / configuration changes identified in the product line analysis phase for sales.</li><li>Initiate development of training plans, procedures and MES work plans.</li><li>Initiate DDA planning and design.</li></ul>	Pu-238 FY21 Total Cost Estimate: \$2,776,000
Q2	<ul style="list-style-type: none"><li>Development for Electronic Product Sales</li><li>DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>Continue the development/configuration changes identified in the product line analysis phase for sales.</li><li>Continue the development of training plans, procedures and MES work plans.</li><li>Continue DDA planning and design.</li></ul>	
Q3	<ul style="list-style-type: none"><li>Development for Electronic Product Sales</li><li>DDA Development</li></ul>	<ul style="list-style-type: none"><li>Continue the development/configuration changes identified in the product line analysis phase for sales.</li><li>Continue the development of training plans, procedures and MES work plans.</li><li>Initiate DDA development</li></ul>	
Q4	<ul style="list-style-type: none"><li>Testing and implementation of Electronic Product Sales</li><li>Testing and implementation of DDA</li><li>Testing and implementation</li><li>DDA Development</li></ul>	<ul style="list-style-type: none"><li>Complete testing and debugging for electronic sales of products.</li><li>Complete implementation phase for electronic sales of lot-based products.</li><li>Continue DDA development</li></ul>	
FY22			
Q1	<ul style="list-style-type: none"><li>Testing and implementation of Electronic Product Sales</li><li>DDA Development</li><li>Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>Continue DDA development.</li><li>Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes.</li></ul>	Pu-238 FY22 Total Cost Estimate: \$3,768,000
Q2	<ul style="list-style-type: none"><li>Updates to Electronic Sales Capability, if needed.</li><li>Acceptance of Electronic Product Sales</li></ul>	<ul style="list-style-type: none"><li>Complete updates to MMP tools (MES, ESP, and Build Book).</li><li>Complete acceptance for electronic sales</li><li><b>Proposed Milestone:</b> Capability for Electronic Sales of Pu-238 lots is implemented and accepted for production at the end of 2QFY22.</li></ul>	
Q3	<ul style="list-style-type: none"><li>DDA testing and implementation</li></ul>	<ul style="list-style-type: none"><li>Initiate testing and implementation of DDA</li></ul>	



	<ul style="list-style-type: none"> <li>• Updates to Electronic Sales Capability, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes.</li> </ul>	
Q4	<ul style="list-style-type: none"> <li>• DDA testing and implementation</li> <li>• Updates to Electronic Sales Capability, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete testing and implementation of DDA</li> <li>• Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes.</li> </ul>	
<b>FY23</b>			
Q1	<ul style="list-style-type: none"> <li>• DDA Acceptance</li> <li>• Updates to Electronic Sales Capability, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete DDA Acceptance</li> <li>• Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes.</li> <li>• <b>Proposed Milestone:</b> Capability for digital data collection in support of Pu-238 manufacturing is implemented and accepted for production at the end of 1QFY23.</li> </ul>	Pu-238 FY2 Total Cost Estimate: \$521 ,000

### *PF-4 Balance of Plant*

In FY22, the project will shift to focus on the implementation of MMS tools for the remaining operations in PF-4. This schedule assumes that the first two operations to transition to electronic product sales will be ARIES and Americium production. As in the other product lines, the requirements for DDA in these areas will be only those accepted by the appropriate program managers. The Balance of Plant implementation will also include activities such as Pit Surveillance, but these are not explicitly noted in the schedule in table 3 as ARIES and Americium are used as representative of the BOP activities.

The schedule and cost estimates for BOP assume, that the bulk of system development is completed in the earlier product lines and the BOP activities will only require a low to moderate amount of development. If a specific product line requires unanticipated significant customization of the MMP suite of tools these cost estimates and schedules will not be sufficient.

**Table 3 – Balance of Plant Tasks, Deliverables, Milestones, and Budget**

	Scope	Tasks / Deliverables / Milestones	Budget Estimate
<b>FY22</b>			
Q3	<ul style="list-style-type: none"> <li>• Product Line Analysis for Electronic Product Sales</li> </ul>	<ul style="list-style-type: none"> <li>• Initiate and complete product line analysis, including process analysis, requirements, gap analysis, and production plan for ARIES.</li> </ul>	BOP FY22 Total Cost Estimate: \$715,000
Q4	<ul style="list-style-type: none"> <li>• Product Line Analysis for Electronic Product Sales</li> <li>• Development for Electronic Product Sales</li> </ul>	<ul style="list-style-type: none"> <li>• Initiate and complete product line analysis, including process analysis, requirements, gap analysis, and production plan for Americium.</li> <li>• Initiate the development/configuration changes identified in the product line analysis phase for sales for ARIES.</li> </ul>	

FY23			
Q1	<ul style="list-style-type: none"><li>• Product Line Analysis for Electronic Product Sales</li><li>• Development for Electronic Product Sales</li><li>• DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>• Initiate the development/configuration changes identified in the product line analysis phase for sales for Americium.</li><li>• Initiate development of training plans, procedures and MES work plans for ARIES</li><li>• Initiate development of training plans, procedures and MES work plans for Americium</li><li>• Initiate DDA planning and design for ARIES</li><li>• Initiate DDA planning and design for Americium</li></ul>	BOP FY23 Total Cost Estimate: \$6,088,000
Q2	<ul style="list-style-type: none"><li>• Implementation and Acceptance of Electronic Product Sales Capabilities</li><li>• DDA Planning and Design</li></ul>	<ul style="list-style-type: none"><li>• Complete the development/configuration changes identified in the product line analysis phase for sales for ARIES.</li><li>• Complete user training for ARIES</li><li>• Complete acceptance for electronic sales for ARIES</li><li>• Complete DDA planning and design for ARIES</li><li>• Complete DDA planning and design for Americium</li></ul>	
Q3	<ul style="list-style-type: none"><li>• Implementation and Acceptance of Electronic Product Sales Capability</li><li>• DDA Development</li></ul>	<ul style="list-style-type: none"><li>• Complete the development/configuration changes identified in the product line analysis phase for sales for Americium.</li><li>• Complete user training for Americium</li><li>• Complete acceptance for electronic sales for Americium</li><li>• Initiate DDA development for ARIES</li><li>• Initiate DDA development for Americium</li></ul>	
Q4	<ul style="list-style-type: none"><li>• DDA Development</li><li>• Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>• Continue DDA development for ARIES</li><li>• Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes for ARIES</li><li>• Continue DDA development for Americium</li><li>• Continue updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes for Americium</li><li>• <b>Proposed Milestone:</b> Capability for Electronic Sales of for ARIES and Am is implemented and accepted for production in 4QFY23.</li></ul>	
FY24			
Q1	<ul style="list-style-type: none"><li>• DDA Testing and Implementation</li><li>• Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>• Complete DDA testing and implementation for ARIES</li><li>• Complete updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes for ARIES.</li><li>• Complete DDA testing and implementation for Americium</li><li>• Complete updates to the MMP tools (MES, ESP, and Build Book), if required to implement the DDA changes for Americium</li><li>• Initiate updates to electronic sales capability if needed for remaining PF-4 operations.</li></ul>	BOP FY24 Total Cost Estimate: \$1,176,000
Q2	<ul style="list-style-type: none"><li>• DDA Acceptance</li><li>• Updates to Electronic Sales Capability, if needed.</li></ul>	<ul style="list-style-type: none"><li>• Complete DDA acceptance for ARIES.</li><li>• Complete DDA acceptance for Americium.</li><li>• Continue updates to electronic sales capability if needed for remaining PF-4 operations.</li></ul>	

		<ul style="list-style-type: none"> <li>• <b>Proposed Milestone:</b> Capability for digital data collection in support of ARIES and Am is implemented and accepted at the end of 2QFY24.</li> </ul>	
Q3	<ul style="list-style-type: none"> <li>• Updates to Electronic Sales Capability, if needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue updates to electronic sales capability if needed for remaining PF-4 operations.</li> </ul>	
Q4	<ul style="list-style-type: none"> <li>• Updates to Electronic Sales Capability, if needed.</li> <li>• Develop lessons learned document.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete updates to electronic sales capability if needed for remaining PF-4 operations.</li> <li>• Document balance of plant lessons learned.</li> <li>• <b>Proposed Milestone:</b> Capability for Electronic Sales is available to all PF-4 operations at the end of FY24.</li> </ul>	

### *Detonator Production at TA-22*

Detonators are currently in full production. That activity and the results of the previous gap analysis are the primary reasons why TA-22 operations are not being addressed until the last two quarters of this plan. Under previous MMP efforts a gap analysis was completed that determined a significant software development effort would be involved in replacing SOMS as more than 30 technology gaps that would take ~ 3 years of effort to close were identified. At the beginning of Q3FY24, an evaluation of the gap analysis and ROI will be conducted. This will be used to make a decision based on ROI to implement MMP tools or leave SOMS in place. This plan specifically lays out the first phases of that effort as any implementation of a SOMS replacement will extend beyond the time period laid out in this plan.

**Table 4 – Detonator Production Tasks, Deliverables, Milestones, and Budget**

	Scope	Tasks / Deliverables / Milestones	Budget Estimate
<b>FY24</b>			
Q1	No Scope for this period.		DETs FY24 Total Cost Estimate: \$480,725.00
Q2	No Scope for this period.		
Q3	<ul style="list-style-type: none"> <li>• Begin evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• Begin evaluation of Gap Analysis and ROI for SOMS Replacement</li> </ul>	
Q4	<ul style="list-style-type: none"> <li>• Complete evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• Complete Gap Analysis and ROI to determine FY25 path forward for detonator production.</li> <li>• <b>Proposed Milestone:</b> Updated Gap, Lessons Learned, and ROI Analysis and decision of whether or not to proceed with SOMS replacement.</li> </ul>	

## 4.3 Approach

### *Serialized Product Production*

The current MMS design has only been tested for serialized product production (e.g. pits, power supplies). In this mode, each individual serialized unit is built, and all its production data collected, against a single work order. The next deployment in Pits will follow that paradigm.

### *Lot-based Product Production*

In lot-based production, multiple units belonging to a single lot are built, and all related production data collected, against a single order. Enhancing the existing capability to accommodate lot-based production will likely require additional development work. The analysis stage of those product lines will include determination of the appropriate solution. Deployment to product lines after Pits that require lot-based production will follow that paradigm.

### *Major Phases for Each Product Line*

Our software quality assurance processes specify following the lifecycle model known as the waterfall method for implementing software tools, but allows for adaptation to meet specific requirements or constraints of any project. This plan follows the intent of the waterfall method, but with the understanding that there is an iterative process within and throughout the lifecycle.

#### 1) Planning: Product Line Analysis

Analyse a given product line to allow detailed project planning and implementation to proceed with high confidence in its success and clear expectations for the outcome. Tasks include (1) Process Analysis, (2) Requirement Development, (3) Gap Analysis, and (4) a fully developed Production Plan.

#### 2) Design

After a full analysis of product line requirements, a team of subject matter experts review the existing system architecture to ensure new product line requirements are met, determine whether additional custom software coding, configuration changes, or some combination of the two is necessary to deliver the required capability.

#### 3) Development

Software development resources execute any custom software coding and/or configuration changes deemed necessary

#### 4) Testing

Development of a test plan and execution of that plan to demonstrate traceability of the requirements through to system capability.

#### 5) Implementation

Development of procedures, training, and business process changes required for end users to implement the software tools.

## **Appendix A: Digital Manufacturing Vision**

### **Summary:**

ALDWP has developed a vision for the usage of information technologies to provide improved program performance for its plutonium operations. Collectively, these information technologies include both new hardware implementation and new software and process implementation. This 5-year plan lays out the path to achieve the effective implementation of technologies so that improved program performance can be realized. This plan is sequenced in four elements so as to provide the most significant capabilities in line with program requirements.

### **Vision:**

The vision is driven by current experiences in other weapons complex operations as well as experience in non-weapons settings. In particular, knowledge of process and operational expectations in non-weapons defence manufacturing is useful. The vision is captured in the four major functional areas required to provide manufacturing productive output. The vision recognizes the rather distinct requirements derived from manufacturing operations involving special nuclear materials and the quality demonstration requirements associated with nuclear weapons and other high-visibility programs at the National level. The vision is stated below in the form of vision statements according to the functional area:

#### **Production planning and scheduling vision**

- Demand for production is entered into a single authoritative system
- The single "demand" system is used to create long-term and intermediate term plans for execution to meet demand. This is called the Master Production Schedule (MPS)
- The single system (integrated with the MPS system) is used to develop what-if scenarios for capacity analysis
- A single authoritative system is used to "explode" the MPS into order level schedules for work execution and inventory management
- A single authoritative system is used to further explode work order level scope into task level work
- The single system has visibility to detailed resource allocations to ensure effective task level scheduling
- A single business process, linked to the authoritative system, is used to communicate Plan of the Week (POW) / Plan of the Day (POD) level work assignments

#### **Production data collection and product sale vision**

- A single system is used to real-time track task-level work completions in the plant
- A single process is used to define data requirements for all production activities include fabrication of products for "sale"
- A single system is used to collect real-time production data whether for product sale, production process improvements, or general research
- A single electronic system is used to demonstrate that products meet requirements and facilitate production sales
- All production operations data is available in a single authoritative system for engineering analysis

**Production operations vision**

- Sets of docked tablets are available at the door of each PF-4 lab room
- Tablets are checked out to the PIC for work. All necessary documentation (including pre-job, DOP, training validation, etc., are available on the tablet)
- The wireless tablets are used for all special nuclear material (SNM) transactions
- Data is collected electronically from equipment (with limited exceptions)
- The tablets are used to status work
- The production operations system provides dynamic data-feed as necessary to P6 schedules for EVMS reporting

**Inventory transaction vision**

- All non-SNM inventory-related transactions are machine-readable driven
- Machine readable based SNM container labels are standardized and used
- All required production non-SNM inventory levels are planned and controlled

## Appendix B: System and Business Process Requirements

Provided below are the individual vision statements associated with the functional area “Production Data Collection and Product Sale Vision”. We address the system and business process requirements derived from each vision statement. We then articulate the business system or process that will be used to meet those requirements. We describe the projects and associated high-level task elements need to bring those business system capabilities or business process outcome to fruition and make them available for program implementation.

A single system is used to real-time track task level work completions in the plant

### Requirements:

1. System must have purpose-built interface to capture task completion
2. System must operate on the classified environment
3. System must have access to personnel training and qualification data
4. System must be linked to manufacturing process flow on a product and serialized basis
5. System must have a real-time reporting and updating capability
6. System must provide an interface to schedule distinct work tasks including estimated resource utilization
7. System must have adequate availability both in location and uptime to ensure accessibility.

### Business system or process description:

1. As deployed, the combination solution of Oracle Discrete Manufacturing (MRP) and Solumina (MES) meets functional requirements through the capability to define work tasks in advance and to status those work tasks in real time
2. Procedures and training to ensure all manufacturing staff operators understand how to use the system and understand usage expectations
3. Appropriate availability of terminals is required to ensure accessibility for real-time data entry
4. Procedures and training to ensure product engineers know how to describe the required sequence of operational tasks

### Projects/High-level tasks:

1. Red Network / Complete build-out of red network in areas of the plant with very limited access
2. 4-logon / Provide installation of Citrix clients in more places in the plant in order to streamline the logon process
3. Laptop demo / Demonstrate the capability to provide classified system access to areas where space is limited for a workstation
4. ESP / completion of associated procedures for both product engineering and operations staff

A single process is used to define data requirements for all production activities include production of products for "sale"

**Requirements:**

1. The system/process must recognize differences in production data requirements
2. System must capture author and reviewer of data requirements and link requirements to design definition
3. The business process must have clearly identified procedures and appropriate training
4. System must provide long-term linkage between definition of data requirements and product so that data requirements can be verified in the future

**Business system or process description:**

1. Product Quality Requirements Map (PQRM) will be used to comprehensively identify product quality requirements
2. Completeness of quality evidence will be evaluated by establishing a crosswalk to objective evidence in data packages

**Projects/High-level tasks:**

1. ESP / Testing to ensure the procedure can be followed with training for all potential product families

A single system is used to collect real-time production data whether for product sale, production process improvements, or general research

**Requirements:**

1. System must have adequate availability to support all potential data generation types and locations
2. System must have digital record repository authority
3. System must be able to link data requirements to data collections by requirement type
4. System must support operator-entered data with data verification tools as well as direct data entry and upload

**Business system or process description:**

1. Digital archive in the form of structure classified file share coupled with data upload to Solumina or Oracle to meet product data sale requirements
2. An improved digital archive will be evaluated

**Projects/High-level tasks:**

1. ESP / A robust list of data generating equipment in PF-4 is required to ensure visibility to data generating locations
2. ESP / verification of capability to store digital production data by type



A single electronic system is used to demonstrate products meet requirements and facilitate production sales

**Requirements:**

1. System must provide strong linkage between product definition, product sale data requirements, and production data used to demonstrate those requirements
2. System must provide time-based record of sale authorization
3. Process must have clearly defined procedures linked to training and qualification requirements

**Business system or process description:**

1. The LANL-developed Electronic Sales Package capability as deployed within the Oracle Business Suite meets these requirements for serialized product as demonstrated in the Spring of 2019

**Projects/High-level tasks:**

1. ESP / Verification of end-to-end procedures and training on the usage of ESP for product sale

All production operations data is available in an authoritative system for engineering analysis

**Requirements:**

1. System must have robust and long-term product-based data search capability
2. System must provide systematic assurance of long-term reliability and availability
3. System must have strong and clear item naming convention to ensure long-term searchability

**Business system or process description:**

1. Purpose-designed folder structure in a classified share drive can be used in the near term to meet these requirement

**Projects/High-level tasks:**

1. Develop a specific procedure and training to ensure appropriate naming convention and controls on the Production Data Shared Drive.

## Appendix C: Projects List

ALDWP has developed a vision for the usage of information technologies to provide improved program performance for its plutonium operations. The tools necessary for electronic sales and quality evidence collection are only a subset of the projects that will be necessary to fully-implement the entire vision (Appendix A). Below is a list of the projects, including those that are part of MMP, that must be implemented to fully realize the vision.

Project Name	Type	Description
4-logon	Hardware	Replaces current zero clients with units that allow single-logon access to Secure Desktop on Demand throughout PF-4.
Tablet Demo	Hardware	Demonstrates both red laptops and tablets in room 319. Deployment with magnet on GB with arm.
Rednet install	Hardware	Installs required classified network drops in 100, 200, 300 area. Walkdowns indicate initial work must begin in the 200 area
PF-4 Wireless	Hardware	Implements the two-tiered project plan to install and operate a classified wireless capability for PF-4
Wireless Tablets	Hardware	Implements the wireless tablet concept for PF-4 with docking stations and magnetic holders at work locations
Red-EDRMS	Hardware	Implements a classified EDRMS (Documentum) that can be fully integrated with the other production systems
ESP / Serialized Product	Software	Completes efforts begun by MMP to create software, procedures, and training to implement an Electronic Sales Package capability using Oracle MRP and Solumina
ESP / Lot-based product	Software	Completes efforts to ensure ESP capability exists for lot-based manufactured product
iMASS 2.0	Software	Implements iCRIT functionality for SNM transactions
iMASS 2.5	Software	Implements SPLITS and COMBINES in simplified interface for SNM transactions
iMASS 3.0	Software	Implements iMAR functionality for SNM transactions
iMASS Barcode	Software	Implements barcodes/QR codes for all SNM transactions including inventory processes
Oracle Production Scheduling	Software	Implements the Oracle Production Scheduling tool with MRP to help deliver improved shop floor coordination and control
MRP-P6 Integration	Software	Creates automated process from MRP to P6 schedules for automated EVMS reporting
Integrated Production Scheduling	Software	Demonstration of systems and processes to resolve input of final deliverables into shop floor scheduling detail. Includes efforts to interface

		manufacturing scheduling functions from other facility work functions
Work Control Integration	Software	Software project to develop specific systems focused on Touch-Screen interface design to support pre-job briefs, access to DOPs, integrated access to MES/MRP and iMASS
ESP / Pits	Implementation	Implementation of ESP systems and processes for Electronic Sale of Pits
ESP / Pu238 (serialized)	Implementation	Implementation of ESP systems and processes for Electronic Sale of Pu238 components
ESP / Balance of Plant	Implementation	Implementation of ESP systems and processes for balance of plant plutonium operations
iMASS/ iCrit	Implementation	Modifications to DOP-016 and associated training and reporting to ensure utilization of the criticality safety control functionality in the SNM transaction interface
iMASS 2.5	Implementation	Training and reporting to allow all operational personnel simplified and error-resistant SPLIT and COMBINE transactions in the ANM accountability system
iMASS 3.0	Implementation	Training and reporting to ensure utilization of the Material-At-Risk control and verification functionality in the SNM transactional interface
iMASS Barcode	Implementation	Training and hardware implementation to provide machine-readable inventory and transaction interfaces for SNM transactions
Integrated Inventory Management	Implementation	Procedures, training, and hardware to implement Oracle Inventory for all material management processes to include machine readable inventory verification and transaction interfaces
Shop Floor Scheduling / Pits	Implementation	Implementation project to utilize Oracle MRP as the production operations shop floor scheduling tool to include real time displays of task completion and status for Pit Production
Shop Floor Scheduling / Balance of Plant	Implementation	Implementation project to utilize Oracle MRP as the production operations shop floor scheduling tool to include real time displays of task completion and status for Balance of Plant operations
Integrated Planning and Scheduling	Implementation	Implementation of procedures and processes to provide an integrated and sustainable planning and scheduling framework recognizing the distinctions between manufacturing processes and non-manufacturing processes
Work Control Integration	Implementation	Implementation of classified tablet software suite and classified wireless capabilities meet a single-point solution for work control and data collection for plutonium manufacturing operations